MINERALOGY AND PETROGRAPY.[1]

Eleolite Rocks from Trans-Pecos Texas.—In a recent report on Trans-Pecos Texas Osann[2] gives a few brief notes on the igneous rocks of the region. The most interesting points in the article, which, on account of the short time allowed the author to prepare it, is little more than a collection of notes, refer to the alteration of limestones by granite and the production of a rock composed almost exclusively of calcium silicates; to the existence of eleolite syenites and phonolites in the Davis Mountains; to the occurrence of a tourmaline schist in the Van Horn Mountains, and of altered diabases and squeezed porphyries in the Carriso Mountains. The eleolite syenite is a fine grained, light colored rock with the typical trachytic structure. It contains orthoclase, eleolite and olivine as phenocrysts and sodalite, aegyrite, malacolite, hornblende, arfvedsonite and the rare minerals ainigmatite, laavenite and pyrrhite in its groundmass. The olivine is nearly colorless in thin section. It usually plays the part of a nucleus around which the other dark components have crystallized. The pyroxene occurs in two generations. The amphiboles are also in two generations, and often these and the pyroxenes are intergrown with their *c* axes and clinopinacoids coinciding. Ainigmatite is common in the rock, laavenite and pyrrhite are rare. The phonolites fall into two types. Those of the first type are characterized by their fine grain, by the abundance of needles and grains of aegyrite in their groundmass, and the absence from them of amphibole and other accessory components. In the rocks of the second type are a few phenocrysts of feldspar and of nepheline, the latter of which are often bordered by a dark corona of bisilicates. The most prominent of these are aegyrite and malacolite among the pyroxenes and among the amphiboles a variety with a strong pleochroism as follows: *A*=dark greenish blue; *B*=dark grayish brown; *C*=light yellowish brown. Cutting the eleolite syenite are dykes of tinguaite, monchiquite, alnoite, ouachitite, and a rock to which the author gives the name paisanite, since it was found in Paisano Pass in the Davis Mountains. This new rock consists of a few phenocrysts of quartz and of sanidine in a dense white matrix spotted with blue hornblende whose optical properties show it to be riebeckite. The white matrix is composed of

[1]Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2]Fourth Ann. Rep. Geol. Survey of Texas p. 123.

intergrowths of albite and orthoclase cemented by granophyric quartz. It is unfortunate that the author cannot further pursue the studies so auspiciously begun.

The Differentiation of Rock Magmas.—In a recent number of the *Journal of Geology* are two contributions relating to the theory of the differentiation of rock magmas. One, by Iddings,[3] is a simple statement of the nature of the phenomena that have led to the proposal of the theory. The article does not discuss the causes of the differentiation of magmas except in general terms, but it deals with the facts that seem to indicate that such a differentiation of a homogeneous magma into unlike parts is alone capable of accounting for the great differences observed in the various rocks emanating from a single volcanic center, and in different portions of the same rock mass. The second article, by Backtsröm[4], was written to call attention to the difficuly of explaining magmatic differentiation upon Soret's principle, which applies, so far as we know, only to dilute solutions, and effects only the proportions existing between the solvent and the dissolved body in different portions of a solution. The author prefers to consider rock magmas as mixtures of liquids, some of which are less soluble in others at certain temperatures than at certain different temperatures. Hence if a homogeneous magma cools to a temperature when some of its constituents become difficultly soluble in the mixture of the others, it will become separated into parts possessing different compositions—liquation will ensue. Thus basic concretions are sometimes formed in acid rocks, and the acid and the basic lavas of Iceland occur in numerous flows, side by side, while intermediate rocks are absent.

The Old Volcanics of South Mountain, Pennsylvania.—Miss Bascom[5] has examined with great thoroughness the acid volcanics of South Mountain, Pa., whose existence was made known to the geological public a year[6] ago, and has described briefly the results of her study. These volcanics exhibit many of the features of modern rhyolites in spite of the fact that they have undergone profound alteration since their eruption. Fluidal, micropoicilitic, spherulitic, axiolitic and lithophysal structures are noticed in the various speci-

[3]Jour. Geol., Vol. I, p. 833.
[4]Ib., Vol. I, p. 773.
[5]Jour. Geol., Vol. I, p. 813.
[6]Amer. Jour. Sci., XLIV, p. 482.

mens; perlitic parting is occasionally detected in them; amygdaloidal phases are not uncommon, while taxitic and trichytic structures are frequently met with. The original components of many of the South Mountain rocks have entirely disappeared and in their place are now found only quartz, epidote, magnetite and leucoxene. These minerals are evidently secondary and yet in some specimens they are associated in micropoicilitic intergrowths, thus indicating to the author the secondary origin of this structure in the present instance. The spherelites in the rocks under consideration are often imbedded in a base that was formerly a glass, though it is now a holocrystalline quartz–feldspar mosaic, which must necessarily be of the nature of a devitrification substance, since the mosaic is crossed by delicate perlitic partings. The rocks of the region are thus comparable with the lava flows of more recent age. Some of them were obsidian, others were lithoidal rhyolites and others holocrystalline rhyolites. The structure of the obsidians is now microcrystalline in consequence of the alteration or devitrification processes to which they have been subjected. They are now felsites or microgranites, but their microgranitic structure is not original. It is the result of devitrification. The author would therefor not call the rock a microgranite, nor an obsidian, but would designate it as an apobsidian or an aporhyolite, indicating that it was once an obsidian which has become devitrified—the preposition signifying that the rock to which it is prefixed has undergone alteration of a specific nature.

Another Occurrence of Websterite.—Another occurrence of the basic rock websterite is reported by Harker[7] from Fobello, Lombardy, Italy. The rock is a dark aggregate of black diallage moulding smaller grains of hypersthene. In thin section the diallage is colorless. An eclogite from Port Tana, Norway, consists of garnets holding inclusions of cyanite, omphacite and zircon, imbedded in a groundmass composed chiefly of colorless omphacite and quartz, in which lie phenocrysts of idiomorphic enstatite. A garnet amphibolite from Sutherland, England, a quartz diorite from Viti Leon, Figi, and a uralitized gabbro from Ena, Tonga Islands, are also described by the same author.

Petrographical News.—The nickel ores of Sudbury, Ontario, like those of Norway and Sweden, are associated with gabbro and norite, along their contact with other rocks. The ores are supposed by

[7]Geol. Magazine, VIII, 1891, p. 1.

Vogt[8] to be cencentrations from the magma that yielded the gabbro since the olivine of this rock often contains small percentages of nickel and other comparatively rare metals. The principal ore is a nickel marcasite with 3—5.5 per cent. Ni. The same author describes a nickeliferous pyrite from Beiern, Norway, whose density is 4.6, crystallization regular and hardness 4. It is not magnetic.

A peculiar quartz-porphyry consisting of quartz phenocrysts and crystals of apatite and an altered mineral supposed to be enstatite imbedded in a very fine grained weakly doubly refracting groundmass, which is water clear in thin section except where bespattered with dust inclusions or amorphous iron oxide, is mentioned by Hornung[9] as probably forming a sheet among the diabases and clay slates near Stalberg in the Harz.

Since many of the Maryland granites enclose fragments of other rocks that have suffered contact metamorphism, and since their microscopic constituents possess the characteristics of substances that have solidified from fusion, while the rock masses are intrusive in other rocks Keyes[10] believes he is justified in regarding them all as eruptive in origin.

Piedmontite from a new American Locality.—The rhyolites[11] of the South Mountain region in Pennsylvania and Maryland are characterized by their pink or bright red color, which, according to Williams,[12] is due to the large quantity of *piedmontite* in them. This rare manganese epidote occurs as a constituent in the rock mass, as radiating fibres filling veins and as well terminated crystals enclosed in *scheelite* occupying cavities in the rock. The latter were well enough developed to afford material for optical study. The elongation of the crystals is parallel to *b*. Their pleochroism is *A*=yellow; *B*=amethyst; *C*=carmine. Optically they are identical with piedmontite from other localities. An analysis gave (after correcting for quartz):

SiO_2	Al_2O_3	Ce_2O_3	R_2O_3	Fe_2O_3	Mn_2O_3	MnO	CaO	MgO	K_2O	Na_2O	H_2O	CuO	PbO	Total
37.37	22.07	.89	1.52	4.78	8.15	2.28	18.83	.30	.81	.27	2.48	.13	.17	=100.05

a result indicating that the South Mountain mineral is intermediate in composition between allanite, true piedmontite and mangan-epidote.

[8]Norges Geol. Undersög., 1892.
[9]Min. u. Petrog. Mitth., XIII, p. 373.
[10]Bull. Geol. Soc. Amer., Vol. IV, p. 299.
[11]AMERICAN NATURALIST, March, 1893, p. 273.
[12]Amer. Jour. Sci., 1893, XLVI, p. 50.

The mineral, when in the groundmass of the rhyolite is often associated with a pale rose epidote (*withamite*) and the common green variety, the latter in some cases surrounding the piedmontite. All of the epidotes are supposed to be of secondary origin.

Some American Minerals.—The interesting mineral *rowlandite* from Llano Co., Texas, to which reference has already been made in these notes, has recently been described by Hidden and Hillebrand[13]. Its color varies from bottle green to a pale drab green shade. It is more vitreous than gadolinite, is transparent in thin splinters and it weathers to a waxy brick red substance. The mineral is isotropic. Its hardness is 6 and its density 4.515. An analysis gave:

SiO_2	X	ThO_2	Ce_2O_3	La_2O_3 etc.	Yt_2O_3 etc.	Fe_2O_3	FeO	MnO	CaO
26.04	.39	.59	5.06	9.34	47.70	.09	4.39	.67	.50
MgO	Alk	H_2O	CO_2	Fl	P_2O_5	Total—O=F			
1.62	.28	.24	.34	3.87	tr	= 101.12—1.63 = 99.99.			

Disregarding the CO_2 and CaO and reducing the rare earths to a hypothetical one with the molecular weight of the yttrium group the formula becomes $Si_4\ Yt_4\ Fe\ Fl_2O_{14}$ or $Fe\ (YtF)_2\ Yt_2\ (Si_2O_7)_2$.

Transparent *xenotine* in small crystals associated with muscovite in a quartz pocket is reported by Hidden[14] from near Sulphur Spring, Alexander Co., N. C., and a green variety of the same mineral from the Brindletown gold district, Burke Co., in the same State. The green xenotine has been found only in the gold gravels, forming the interior portions of some of the rough brown crystals intermingled with the sand. It is thought to be original substance from which the brown material was derived by weathering. An analysis of the green mineral indicates a complicated composition:

SiO_2	ZrO	UO_2	ThO_2	Al_2O_3	Fe_2O_3	$(La\ Di)_2O_3$	$(Yt\ Er)_2O_3$	CaO	P_2O_5	F	H_2O
3.46	1.95	4.13	tr	.77	.65	.93	56.81	.21	30.31	.06	.57

In a paper entitled "Minerological Notes" Moses[15] describes *pyrite* crystals from a cavity in limestone at King's Bridge, N. Y. The crystals are octahedral in habit, with the octahedral faces striated parallel to $\infty 0\infty$ and $\infty 02$. On the diploid and pyritoid faces the striations are parallel to their intersections, while the cubic faces are unstri-

[13]Amer. Jour. Sci., XLVI, 1893, p. 208. Cf. also AMER. NAT., 1893, p. 248.
[14]Ib., XLVI, 1893, p. 254.
[15]Ib., XLV, 1893, p. 488.

ated. The same author[16] has analyzed *ettringite* from the Lucky Cuss Mine, Tombstone, Arizona. The mineral is in aggegrates of radiating fibres resembling in appearance a fibrous pectolite. These fibres are doubly refracting and have apparently a parallel extinction. The analysis of selected material gave:

SiO_2	Al_2O_3	CaO	SO_3	H_2O at 115°	Loss at red heat	Total
1.901	10.157	25.615	17.675	33.109	10.872 =	99.329

Reduced, these figures correspond with the formula

$$2\,[(H_{\frac{14}{5}}\,Ca\,Al_2)\,O_3]_2\,SO_3 + 8\,H_2O.$$

Pentlandite occurs at the Sudbury Mine in Ontario, intergrown with massive pyrrhotite. Penfield finds[17] its density to be about 5, and its composition: S = 33.42; Fe = 30.25; Ni = 34.23; Co = .85; gangue = .67. This corresponds to (Fe Ni) S, in which Fe: Ni = 1:1.32. The three supposed new sulphides *folgerite*, *blueite* and *whartonite* described by Emmens from this locality are thought by Penfield to be nickeliferous pyrite (blueite and whartonite) or mixtures of pentlandite with some impurity (folgerite).

Hidden reports[18] two new localities for gem *turquoise*. One is in the Cow Springs district of Grant Co., N. M., fifteen miles south of the Azure Mining Company's claim in the Burro Mountains, and the other is 150 miles east of the Burros in the Jarilla Mountains, Doña Ana Co., in the same State. Both localities were formerly worked by the natives. The matrix of the mineral in both cases is a trachyte traversed by fissures filled with quartz, limonite, kaolin, jarosite and other minerals. The kaolin is the result of alteration of the trachyte and the turquoise is regarded as a further alteration product of the kaolin.

A list of the minerals known to occur in Michigan is given by Hubbard.[19] Among these is a talc which the author calls *beaconite*. It occurs in fibres like those of asbestus, with an index of refraction = 1.5–1.6, an optical angle $2V = 60°$, and a density of 2.74–2.88 Their composition as found by Packard is:

[16] Cf. also Zeits. f. Kryst., XXII, p. 16.
[17] Ib., XLV, 1893, p. 493.
[18] Ib., XLVI, 1893, p. 400.
[19] Rep. State (Mich.) Board of Geol. Survey, Lansing, 1893, p. 171.

SiO_2	Fe_2O_3 . FeO	MnO	MgO	Ign	Total
59.72	8.67	.64	26.42	4.13	= 99.58

corresponding to H_2 (Mg Fe)$_3$ $(SiO_4)_3$.

A pink vitreous *zoisite* found at the Flat Rock Mine, Mitchell Co., N. C., associated with monazite and allanite, has been analyzed by Eakins.[20] Its composition is:

SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	H_2O	Total
38.98	31.02	4.15	.23	23.80	2.03	= 100.21

Specimens of *cacoxenite* from six localities have been examined optically by Luquer[21]. All the crystals show parallel extinction, and a few of the larger ones appear pleochroic in orange and light yellow tints. From a few measurements the approximate axial ratio 1: .75 was calculated.

The *heulandite*[22] from McDowell's quarry, Upper Montclair, N. J., crystallizes in forms agreeing essentially with those of crystals from Baltimore.

The material of the pale green crystals of muscovite from the dolomite of King's Bridge, N. Y., is a mica of the first order. Its apparent axial angle is $2E = 62° 11'$, $2E = 60° 37'$.

Mineral Syntheses.—The ferrous bye-products of aniline factories at Laar, near Ruhort, Westphalia, when dumped upon the ground to dry, are so rapidly oxidized that the heaps soon become too hot to handle. The material hardens and assumes a metallic lustre.[23] On the walls of cavities within it crystals form whose habit is that of *hematite* but whose composition indicates an admixture of hematite with magnetite.

Upon heating to 1200° in a graphite crucible for several hours, one part of titanic iron and two and a half parts of pyrite, Michel[24] obtained a crystalline mass with the properties of *pyrrhotite*. This is filled with vacuoles on whose walls are implanted tiny crystals of *rutile* with the characteristics of the natural mineral.

Monticellite in well developed acicular crystals is reported by von

[20]Amer. Jour. Sci., 1893, XLVI, p. 154.
[21]Ib., 1893, XLVI, p. 154.
[22]A, J. Moses: School of Mines Quart., XIV, p. 326,
[23]Zeits. d. deutsch. geol. Ges., XLV, p. 63.
[24]Bull. Soc. Franc. d. Min., XVI, p. 37.

Gümbel[25] as existing in the slowly cooled silicate slags from the lead furnace at Friehung near Vilseck in Bavaria.

V. Goldschmidt[26] calls attention to the advantage of glass over charcoal in securing sublimates of volatile substances arising during blowpipe analysis. He also gives the description of an apparatus which enables the manipulator to reduce his metallic compounds upon charcoal and collect their sublimates upon ordinary object glasses.

[25]Zeits. f. Kryst., XXII, p. 269.
[26]Zeits. f. Kryst., XXI, p. 329.